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ABSTRACT

Designed to assist chemistry teachers in selecting appropriate software programs, this publication is the second in a series of six teacher's guides from Project SERAPHIM, a program sponsored by the National Science Foundation. This guide is keyed to the chapters of the text "Chemical Principles." Program suggestions are arranged in the same order as the chapters of the textbook and are classified by topic and by type of classroom use. Information on each program includes: (1) name; (2) disk number; (3) topics; (4) grade levels; and (5) a description. Guidance is also offered regarding methods by which each program can be used most effectively. Summary lists of recommended programs for Apple, IBM, and Commodore systems, as well as for other microcomputers, are provided. Specified in these lists are the SERAPHIM disk number, the hardware availability, the program's name(s), and the recommended chapters for use. (ML)

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TEACHER'S GUIDE

TO SERAPHIM SOFTWARE

II

Chemical Principles

by

Donna J. Bogner

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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NOTE: How textbooks were selected.

The decision to provide a Teacher's Guide for this textbook was made on the basis of input from classroom teachers and in no way implies that Project SERAPHIM or NSF Science Education recommend or endorse a particular textbook.

TEACHER'S GUIDE
TO SERAPHIM SOFTWARE
II

TO ACCOMPANY

Chemical Principles

Author: William L. Masterton, Emil J. Slowinski & Conrad L. Stanitski

Publisher: Saunders College Publishing

Edition and Date: 6th edition, 1985

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TEACHER'S GUIDE TO SERAPHIM SOFTWARE II.

TO ACCOMPANY THE TEXT, Chemical Principles

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Preface

This Teacher's Guide to SERAPHIM Software was written to help you and other chemistry teachers make appropriate selections of software programs. It suggests specific SERAPHIM programs that can be used as you teach from each chapter in this book; suggestions are also made regarding methods by which each program can be used most effectively. The program suggestions are arranged in the same order as the chapters in the textbook, and are classified by topic and by type of classroom use. The brief description for each program includes information to facilitate your decision about when and how to include this program in your course schedule.

How programs were selected. This Teacher's Guide includes only a part of the entire SERAPHIM software collection. Selections were based on two criteria: 1) lists of favorite programs suggested by teachers who have used SERAPHIM software; and 2) programs we considered most appropriate for high school and general college chemistry courses. (Refer to the SERAPHIM Catalogue for a complete listing of software distributed by SERAPHIM.)

How textbooks were selected. The decision to provide a Teacher's Guide for this textbook was made on the basis of input from classroom teachers and in no way implies that Project SERAPHIM or NSF Science Education recommend or endorse a particular textbook.

Teacher's Guide database. This guide was prepared by entering information about each of about one hundred SERAPHIM programs into a database and then searching the database for programs applicable to each chapter in the textbook. In fall 1986 we expect to make the database available on disk and have it appear in the SERAPHIM Catalogue; it requires that you have an IBM PC with two disk drives and dBASE III software. (See SERAPHIM News for announcement of availability.) Teacher's Guides for this and five other textbooks will continue to be available in printed form: TG 001, Chemistry: Experimental Foundations by Parry, Bassow, Merrill & Tellefsen; TG 003, Modern Chemistry, by Metcalfe, Williams & Castka; TG 004, Chemistry: A Modern Course, by Smoot, Price & Smith; TG 005, Chemistry: The Central Science, by Brown and LeMay; TG 006, Chemistry: The Study of Matter by Dorin.

Sample of Teaching Tips. At the end of this Teacher's Guide (on yellow paper) you will find one example of what we call Teaching Tips: SERAPHIM Software--more detailed suggestions for using SERAPHIM programs. Teaching Tips are intended for persons who have selected a program by using this guide or the SERAPHIM Catalogue and then want specific suggestions for and examples of its use in the classroom. A series of Teaching Tips will be ready for distribution in late Fall 1986--see SERAPHIM News for details.

Acknowledgment. We want to express our thanks to the many teachers who have contributed ideas, lists of favorite programs, suggestions for use of programs, etc. Their help has been invaluable in creating this document.

Ypsilanti, Michigan
August 18, 1986

SUMMARY LIST OF RECOMMENDED PROGRAMS: Apple, IBM*, Commodore*

SERAPHIM DISK NUMBER	HARDWARE AVAILABILITY *	PROGRAM NAME(S)	RECOMMENDED FOR CHAPTERS...
AP 101	α	Graphitti	01
AP 102	αβ	Significant Figure Drill	01
	αβ	Graph	01
AP 104	α	Dimensional Analysis	01
AP 105		Vernier	01
AP 201	β	Bohr Atom	07
	α	Chemical Hangman	28
	α	Order The Elements	08
	αβ	Hydrogen	07
AP 202		Quantum Mechanics	07
	α	Electron Arrangement	07
	αβ	Spectral Lines Experiment	07
AP 204		Rutherford	02
AP 205	α	Millikan Oil Drop Experiment	02
	α	Peeks -- 1984	10
		Elemental Analysis	03
AP 206		Chemical Pursuit	28
AP 301	αβ	Isomers	10,21,25
	αβ	(Empirical) Formula	03
	α	Excess	19
	α	Name The Ions	03
		VSEPR	09,10
AP 303		Naming	03
AP 304	αβ	Moles in Space	02
	αβ	Mole Calculations	02
	αβ	Quiz on Molar Masses	02
AP 305	α	Mole Demo	02
		Balanced Equations	03
	α	Valence Drill	03
	α	Mole Exercise	06
	α	Mole Drill	02
		Mole-Mole Tutor	02

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* HARDWARE AVAILABILITY: All programs available for Apple. α This program is also available on IBM disk of the same number code. β This program is also available on COMMODORE disk of the same number code.

SUMMARY LIST OF RECOMMENDED PROGRAMS: Apple, IBM*, Commodore*

SERAPHIM DISK NUMBER	HARDWARE AVAILABILITY*	PROGRAM NAME(S)	RECOMMENDED FOR CHAPTERS...
AP 306		Redox Game	24
		Limiting Reagent	23
		Stoichiometry	03
		Drill on Mole Concept	02
AP401	α	Boyle	06
	α	Charles	06
	α	Boyle's Law Simulation	06
	α	Gas Laws	06
AP 402	α	Gas Law 7	06
	α	Cal 9	11
	α	Balloon	06
	α	Lab Calculation -- Boyle's Law	06
	α	Gas Law 542	06
AP 403	α	Dalton	06
AP 501	α	Rast 2	12
	α	Titration Curves	19
	α	Acid Strenth	19
	α	ABS Game	11
	α	Acid-Base Problems	19,20
	α	Lowry/Bronsted	20
	α	Weak Acid/Base	19
	α	Concentration Quiz	12
AP 502	α	Precipitation Game	18
	α	Molarity	12
	α	PH (7 Programs)	19
	α	Solubility	18
AP 503		pH Plot	19
AP 601	α	Equilibrium Simulation	20
	α	Beginning Thermo Drill	05
	α	Ball Toss	15
	α	Reaction Rates	16
	α	Rates	16
	α	Kinetics - A Lab Simulation	16
		Balance	23
	α	Nernst	24
AP 602		Chemical Dungeons	20

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* HARDWARE AVAILABILITY: All programs available for Apple. α This program is also available on IBM disk of the same number code. β This program is also available on COMMODORE disk of the same number code.

SUMMARY LIST OF RECOMMENDED PROGRAMS: Apple, IBM*, Commodore*

SERAPHIM DISK NUMBER	HARDWARE AVAILABILITY*	PROGRAM NAME(S)	RECOMMENDED FOR CHAPTERS...
AP 603	α	Molecular Speed Distribution	06,16
	α	Faraday Aid	23
	α	Faraday 2	23
	α	An Equilibrium Simulation	15,16
		Animation	16,28
	α	Equil Tic-Tac-Toe	15,20
AP 604		Electrodep	23
		BUCL	16,28
		Backtiter	20
AP 605		Xenon	15,26
AP 606		Kintherm	16
		Kintherm Standards	16
AP 701	α	Design-A-Drug	28
AP 702		Polymerlab	28
AP 704		CAMM: Conformational Analysis & Molecular Modeling	28
AP 705		Polymerization	28
		Organic Nomenclature	28
AP 706		Conformational Analysis	28
AP 801	αβ	Sulfuric Acid	16,17
AP 802	αβ	Waqual	12
AP 803	α	Octane	28
AP 804		Lake Study	01,17,28
AP 805	α	BCTC	01
AP 806		Refinery	28
AP 807		Mineral Resources	14
AP 808		Separations	12,18

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* HARDWARE AVAILABILITY: All programs available for Apple. α This program is also available on IBM disk of the same number code. β This program is also available on COMMODORE disk of the same number code.

SUMMARY LIST OF RECOMMENDED PROGRAMS: Apple, IBM*, Commodore*

SERAPHIM DISK NUMBER	HARDWARE AVAILABILITY*	PRROGRAM NAME(S)	RECOMMENDED FOR CHAPTERS...
AP 809		Pond Study	01,17,28
AP 902	αβ	Six Solution Problem	01,18
		Chemical Search	12
	β	Chemprop	11,13
	β	Element Search	08
	αβ	Canal 1,2,3	22
		Canal 4,5	22
AP 1001		Decay	02,27
AP 1201	β	Heats of Reaction	14
AP 1202	β	Photochromic Kinetics	21,25
AP 1203	β	General Laboratory Interfacing	05,16,21

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* HARDWARE AVAILABILITY: All programs available for Apple. α This program is also available on IBM disk of the same number code. β This program is also available on COMMODORE disk of the same number code.

SUMMARY LIST OF RECOMMENDED PROGRAMS: Other

SERAPHIM DISK NUMBER	PROGRAM NAME(S)	RECOMMENDED FOR CHAPTERS...
ATARI		
AT 201	Rutherford	02
AT 301	Moles in Space	02
	(Empirical) Formula	03
AT 401	Dalton	06
	Boyle	06
	Charles	06
AT 501	Solubility	18
	Rast 2	12
AT 801	Sulfuric Acid	16,17
AT 802	Waqual	12
AT 803	Octane	28
AT 804	Lake Study	01,17,28
AT 805	BCTC	01
AT 806	Refinery	28
AT 807	Mineral Resources	14
AT 901	Canal 1,2,3	22
	Six Solution Problem	01,18
	Element Search	08
	Chemical Search	12
MACINTOSH		
MC 304	Moles in Space	02
MC 801	Sulfuric Acid	16,17
MC 901	Canal 1,2,3	22
	Canal 4,5	22
	Six Solution Problem	01,18
MC 902	Element Search	08
	Chemical Search	12
TRS-80		
TR 001	Chemical Hangman	28

Chapter 01 Matter and Measurements

PROGRAM NAME: SIGNIFICANT FIGURE DRILL

DISK NUMBER: AP102,CO102,IB102

TOPICS: Significant Figures

USES: Drill & Practice
Tutoring

LEVELS: No background in chemistry
High school chemistry or science
General college chemistry

DESCRIPTION: SIGNIFICANT FIGURE DRILL is designed for student use as a tutoring or drill exercise in the use of significant digits. The user has the option of reviewing the rules, quizzing the computer, or working on drill problems. The computer keeps score of correct answers for the user.

PROGRAM NAME: GRAPH

DISK NUMBER: AP102,CO102,IB102

TOPICS: Graphing
Data Analysis

USES: Data Analysis
Demonstration

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program as a demonstration before the first quantitative lab report requiring graphing and data analysis is due. GRAPH will accommodate up to 80 sets of data, with the option of graphing algebraic, log, or trig functions, and giving the user printed or video data table, first derivatives, or least squares analysis as well as slope and intercepts of lines.

PROGRAM NAME: DIMENSIONAL ANALYSIS

DISK NUMBER: AP104,IB104

TOPICS: Dimensional Analysis

USES: Drill & Practice
Tutoring

PROGRAM NAME: DIMENSIONAL ANALYSIS (Continued)

LEVELS: High school science or chemistry
General college chemistry

DESCRIPTION: This program presents the user with dimensional analysis problems using length, volume, mass, and energy units. The final section has practice problems from all the previous sections.

PROGRAM NAME: VERNIER

DISK NUMBER: AP105

TOPICS: Methods of Chemistry
Laboratory Techniques

USES: Drill & Practice
Pre Lab Discussion
Simulation

LEVELS: High school science or chemistry
General college chemistry

DESCRIPTION: This program provides randomly generated simulations of vernier scales, such as are found on barometers and analytical balances, for the user's practice. This program could also be used to demonstrate the use and reading of vernier scales before the students go to the lab.

PROGRAM NAME: BCTC

DISK NUMBER: AP805,AT805,IB805

TOPICS: Industrial Chemistry
Environmental Chemistry
Methods of Science

USES: Problem Solving
Introduce Concept
Simulation

LEVELS: No background in chemistry
High school science or chemistry
Advanced first level and middle level chemistry

DESCRIPTION: The user(s) must make recommendations to the local city government regarding data on BCTC, a suspected carcinogen, which has been found in the river below a chemical plant. The user has literature, a laboratory, and other task force members available to help decide on the recommendation to be made. This is an excellent application of scientific method, especially since no conclusive answer can be given to the problem.

PROGRAM NAME: POND STUDY

DISK NUMBER: AP809

TOPICS: Environmental Chemistry
Problem Solving
Methods of Chemistry

USES: Problem Solving
Educational Game
Simulation

LEVELS: No background in chemistry
High school science or chemistry

DESCRIPTION: The user(s) is an ecologist who has been asked to develop a hypothesis about what is causing a fish kill. The report must be supported by experimental and literature data. A simulated library and laboratory are available to the user. The same format as LAKE STUDY (AP804) but less rigorous. Good application of scientific method.

PROGRAM NAME: GRAPHITTI

DISK NUMBER: AP101,IB101

TOPICS: Graphing
Methods of Chemistry

USES: Data Analysis

LEVELS: No background in chemistry
High school science or chemistry
General college chemistry

DESCRIPTION: This program helps the user organize data into table or graph form. Capacity up to 50 rows and 4 columns in data table. User has choice of plotting any two variables in the data table in graph form. Program emphasizes the use of units for all measurements. Use this program for individual or classroom sets of data.

PROGRAM NAME: LAKE STUDY

DISK NUMBER: AP804,AT804

TOPICS: Environmental Chemistry
Problem Solving
Methods of Chemistry

USES: Problem Solving
Simulation

PROGRAM NAME: LAKE STUDY (Continued)

LEVELS: No background in chemistry
High school science or chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program guides the user through the steps of solving a scientific problem--a fish kill in a hatchery. Animation allows the user to search the library, to use colleagues' expertise, to sample and analyze lake water, and to check the fish in order to identify the pollutant killing the fish. In the second part of the program the user sets up controlled experiments in the lab to check the hypothesis in part one.

PROGRAM NAME: SIX SOLUTION PROBLEM

DISK NUMBER: AP902,AT901,CO902,IB902,MC901

TOPICS: Descriptive Chemistry
Solution Chemistry
Periodicity

USES: Problem Solving
Educational Game
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program, which needs a color monitor to be effective, could be used on first day of class to stimulate interest in the course. Later on it could be used to introduce solution chemistry or periodicity, since it uses three sodium salts (two are sodium halides) and silver nitrate. SIX SOLUTIONS was designed for problem solving; the user mixes the six solutions, two at a time, in a spot plate and from the results determines the contents of the six test tubes.

Chapter 02 Atoms, Molecules, and Ions

PROGRAM NAME: RUTHERFORD

DISK NUMBER: AP204,AT201

TOPICS: Atomic Structure
Nuclear Chemistry/Radiation
Methods of Chemistry

USES: Demonstration
Tutoring
Problem Solving

PROGRAM NAME: RUTHERFORD (Continued)

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program is an excellent introduction to the "indirect evidence" approach to atomic structure modeling. Side 1 of this disk is a simulation of alpha-particle scattering that could be effectively used either as a classroom simulation or for individual tutoring. Side 2 allows user to experiment creatively with the scattering phenomena.

PROGRAM NAME: MOLES IN SPACE

DISK NUMBER: AP304,AT301,CO304,IB304,MC304

TOPICS: Moles
Problem Solving

USES: Educational Game
Drill & Practice

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This drill and practice game gives the user 100 time units to solve three problems changing grams and molar masses to moles. Any time units left over can be redeemed in another computer game on the disk. The user will need a calculator and a periodic table to play MOLES IN SPACE.

PROGRAM NAME: MOLE DEMO

DISK NUMBER: AP305,IB305

TOPICS: Moles

USES: Demonstration
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This animated program simulates the stacking of paper a mole high from the surface of the earth, while keeping numerical data on the number of sheets of paper and the distance from the earth at the bottom of the screen. A very good "visualization" of how large a mole really is.

PROGRAM NAME: MILLIKAN Oil Drop Experiment

DISK NUMBER: AP205,IB205

TOPICS: Atomic Structure

USES: Demonstration
Simulation
Data Collection

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: "Focus" on the individual oil drop and change the applied potential on the drop to keep it from moving. Use this simulation to introduce the concept of the charge on the electron. The program has four pages of mathematical formulae that guide the user through the calculations of the charge on the oil drop. Full screen animation makes this program suitable as a lecture and demonstration aid.

PROGRAM NAME: MOLE CALCULATIONS

DISK NUMBER: AP304,CO304,IB304

TOPICS: Moles
Problem Solving

USES: Drill & Practice
Educational Game

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This game-format drill and practice program can accommodate up to six users, each working the same mole calculation with a different assigned "given" starting amount. Assign it for individual help or for competition. The computer can be used as a calculator by keyboard command.

PROGRAM NAME: QUIZ ON MOLAR MASSES

DISK NUMBER: AP304,CO304,IB304

TOPICS: Moles

USES: Review Concept
Drill & Practice

LEVELS: High school chemistry
General college chemistry

PROGRAM NAME: QUIZ ON MOLAR MASSES (Continued)

DESCRIPTION: This 12-problem quiz randomly presents the user with the chemical formula and the name of a compound and a choice of four molecular weights. The user inputs the letter of the molecular weight selected. The computer keeps the user's score.

PROGRAM NAME: MOLE DRILL

DISK NUMBER: AP305,IB305

TOPICS: Moles

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This drill and practice program gives the user problems in changing moles to grams, molecules to moles, amu's to grams, grams to molecules. Correct answer is given in response to an incorrect input.

PROGRAM NAME: MOLE-MOLE TUTOR

DISK NUMBER: AP305

TOPICS: Stoichiometry

USES: Tutoring
Introduce Concept

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: The user has the option of starting with grams, moles, or molecules in this tutoring program using the reaction of aluminum hydride and water. The computer shows the mole ratios of reactants and products and carries out the calculations required while explaining the procedure to the user.

PROGRAM NAME: DRILL ON MOLE CONCEPT

DISK NUMBER: AP306

TOPICS: Moles

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry

PROGRAM NAME: DRILL ON MOLE CONCEPT (Continued)

DESCRIPTION: This drill program gives the user practice in changing moles to molecules to grams to atoms. When the user inputs a wrong answer, the solution is shown.

PROGRAM NAME: DECAY

DISK NUMBER: AP1001

TOPICS: Nuclear Chemistry/Radiation
Atomic Structure

USES: Simulation
Demonstration
Data Collection

LEVELS: No background in chemistry
High school science or chemistry
General college chemistry

DESCRIPTION: Collect the data from three or more successive runs of this program to illustrate the "randomness" of radioactive decay. The graphics in this program are suitable for use as a classroom demonstration that simulates the decay of 1000 atoms of a mystery substance. A hard copy of the data can be obtained or a bar graph is available on screen.

Chapter 03 Chemical Formulas and Equations

PROGRAM NAME: (EMPIRICAL) FORMULA

DISK NUMBER: AP301,AT301,CO301,IB301

TOPICS: Analytical Chemistry
Formulas
Laboratory Techniques

USES: Prelab Discussion
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program as part of your pre-lab instructions or for individual tutoring in correct lab procedure for obtaining correct data in determining the empirical formula of potassium chlorate from the decomposition of the compound. This program could also be used as a substitute for the actual lab procedure if you are concerned about beginning chemistry students heating potassium chlorate.

PROGRAM NAME: NAMING

DISK NUMBER: AP303

TOPICS: Chemical Formulas
Oxidation States
Inorganic Nomenclature

USES: Drill & Practice
Tutoring

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Excellent drill and practice program for individual use. The management system allows the instructor to get a printed copy of user's score in areas of naming elements, writing chemical symbols, naming and writing formulas of inorganic compounds. Program gives user hints as to what is wrong with the answer and three chances to give the correct answer before it is shown on the screen.

PROGRAM NAME: BALANCED EQUATIONS

DISK NUMBER: AP305

TOPICS: Chemical Reactions
Moles
Stoichiometry

USES: Drill & Practice
Review Concepts
Tutoring

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This excellent drill and practice program gives help during both the equation balancing and mass-mass problem solving sections without solving the problems for the user. The program could be used as an assignment or for extra practice.

PROGRAM NAME: NAME THE IONS

DISK NUMBER: AP301,IB301

TOPICS: Inorganic Nomenclature

USES: Drill & Practice

PROGRAM NAME: NAME THE IONS (Continued)

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This four-level drill program will give the user lots of practice naming randomly selected inorganic anions. After two incorrect responses, the computer gives the correct answer.

PROGRAM NAME: ELEMENTAL ANALYSIS

DISK NUMBER: AP205

TOPICS: Chemical Formulas
Percentage Composition

USES: Calculations
Lab Data Check

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: The computer calculates the percentage composition to the nearest 1/1000 for the empirical formula that the user inputs.

PROGRAM NAME: VALENCE DRILL

DISK NUMBER: AP305,IB305

TOPICS: Oxidation States

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: User is timed as he/she inputs the oxidation states of ten inorganic ions or radicals randomly generated by the computer. The program accepts valences in many forms, -2, 2- and --.

PROGRAM NAME: STOICHIOMETRY

DISK NUMBER: AP306

TOPICS: Stoichiometry

USES: Tutoring
Drill & Practice

PROGRAM NAME: STOICHIOMETRY (Continued)

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This program can be used for tutoring or drill in the solution of mass-mass problems. The user must convert the given mass to moles, input the number of moles of the unkown formed and then convert the moles to grams. There is a periodic table available in the program.

Chapter 04 Sources of the Elements

Chapter 05 Thermochemistry

PROGRAM NAME: BEGINNING THERMO

DISK NUMBER: AP601,IB601

TOPICS: Thermodynamics
Energy/Enthalpy

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This drill and practice program has a management system and hint sections that help the user work randomly assigned problems in beginning thermodynamics.

PROGRAM NAME: GENERAL LABORATORY INTERFACING

DISK NUMBER: AP1203,CO1203

TOPICS: Interfacing

USES: Data Collection
Data Analysis
Interfacing

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

PROGRAM NAME: GENERAL LABORATORY INTERFACING (Continued)

DESCRIPTION: User can calibrate and test a thermistor or Blocktronic I interfaced to the computer. The devices can then be used to monitor changes continuously or sample at intervals. Both graphic and numeric data displays are available and data files can be created. The written materials in LM 010, LM 002, and LM 003 contain specific instructions for construction and use of the interface devices.

Chapter 06 Physical Behavior of Gases

PROGRAM NAME: DALTON

DISK NUMBER: AP403,IB403,AT401

TOPICS: Gas Laws

USES: Simulation
Educational Game

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: User adds gas or heat to an enclosed gas, using game paddles, to attain a maximum pressure without exceeding the "blow-out" pressure. This can be done in competition format or by experimental design.

PROGRAM NAME: BALLOON

DISK NUMBER: AP402,IB402

TOPICS: Gas Laws

USES: Simulation
Demonstration
Introduce Concept

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program helps students visualize the direct and inverse relationships between temperature, pressure, and volume of an enclosed gas. The user inputs a change in either pressure or temperature and the volume of balloon on the right of the screen reflects this change. The original balloon also remains on the screen for comparison. Bar graphs at the top of the screen reinforce the relationships of pressure, volume, and temperature.

PROGRAM NAME: BOYLE

DISK NUMBER: AP401,AT401,IB401

TOPICS: Gas Laws
Data Analysis

USES: Demonstration
Simulation
Data Analysis

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This simulation program could be used as a substitute* for the lab procedure, either by the whole class or for an individual who missed the lab. The graphing (analysis of data) portion could be an effective lecture aid to help students see the relationships between pressure and volume of enclosed gases or it could be used as a tutoring device for students having problems completing the Boyle's Law laboratory report. (*A safe substitute, since the use of mercury is eliminated.)

PROGRAM NAME: CHARLES

DISK NUMBER: AP401,AT401,IB401

TOPICS: Gas Laws

USES: Data Collection
Simulation

LEVELS: High school science or chemistry
General college chemistry

DESCRIPTION: This simulation of Charles' Law allows the user to collect data that shows the relationship between volume and temperature of an enclosed gas. Because it is programmed for easy access by a number of students, one could use this as a safe substitute for heating air trapped by mercury plugs.

PROGRAM NAME: GAS LAW 7

DISK NUMBER: AP402,IB402

TOPICS: Gas Laws

USES: Tutoring
Introduce Concept

LEVELS: High school science or chemistry
General college chemistry

PROGRAM NAME: GAS LAW 7 (Continued)

DESCRIPTION: This introduction to gas laws program allows the user to input values for one of the variables that affect enclosed gases and the computer calculates the values for the other variable. From that information the user answers questions about the kind of relationships derived. Individual students could use this program to an advantage.

PROGRAM NAME: MOLE EXERCISE

DISK NUMBER: AP305,IB305

TOPICS: Moles
Gas Laws

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This drill and practice program has ten problems relating to molar volumes (STP), Avagadro's number, and molar masses of gases in multiple choice form. User gets only one chance to input answer. Solutions are shown for incorrect answers.

PROGRAM NAME: BOYLE'S LAW SIMULATION

DISK NUMBER: AP401,IB401

TOPICS: Gas Laws

USES: Data Collection
Simulation

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This program simulates the CHEM Study lab where students collect data to show the relationship between pressure and volume of an enclosed gas using syringes and books. The user can collect data by adding one book at a time and reading the volume of gas in the syringe. Successive runs of the program do NOT give you exactly the same readings, so the program can be used to collect class data by individual students.

PROGRAM NAME: GAS LAWS

DISK NUMBER: AP401,IB401

TOPICS: Gas Laws

USES: Tutoring

PROGRAM NAME: GAS LAWS (Continued)

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This gas law tutorial program offers the user the option of approaching the solution of problems by either the formula method or the logic method after a graphic background is presented.

PROGRAM NAME: LAB CALCULATION--BOYLE'S LAW

DISK NUMBER: AP402,IB402

TOPICS: Gas Laws

USES: Lab Data Check
Data Analysis

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This program will accept volume from three trials, using up to three books pressure each, from pressure-volume labs similar to CHEM Study Lab 4, and will return a print-out of the average volume plus the uncertainty as well as the high and low values of 1/volume. Printer is necessary.

PROGRAM NAME: GAS LAW 542

DISK NUMBER: AP402,IB402

TOPICS: Gas Laws

USES: Introduce Concept
Tutoring

LEVELS: High school chemistry

DESCRIPTION: This is simple version of GAS LAW 7, where the user inputs the number of moles, volume, temperature and pressure of an enclosed gas to obtain a data table that shows the relationship between two of the variables. The user then answers questions based on this table.

PROGRAM NAME: MOLECULAR SPEED DISTRIBUTION

DISK NUMBER: AP603,IB603

TOPICS: Kinetics
Reaction Rates
Gas Laws

PROGRAM NAME: MOLECULAR SPEED DISTRIBUTION (Continued)

USES: Demonstration
Introduce Concept
Simulation

LEVELS: High school chemistry or science
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The ability to graph the speed distribution for a gas of your choice at many temperatures on the same screen makes this simulation program a natural for classroom demonstration of the relationship between molecular speed and reaction rates. You can use a temperature range from 1K to above 10,000K.

Chapter 07 The Electronic Structure of Atoms

PROGRAM NAME: BOHR ATOM

DISK NUMBER: AP201,CO201

TOPICS: Atomic Orbitals
Atomic Structure
Electron Configuration

USES: Simulation
Tutoring
Problem Solving

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This simulation program allows user to select the wavelength of radiation to "excite" an electron in the ground state of the hydrogen atom. Animation shows the radiation exciting the electron, the radiation given off when the electron falls back to ground state, and demonstrates the relationship between the atom's return to ground state and the wavelength(s) of radiation chosen. User may use trial and error or calculate the wavelength of light necessary for a specific transition before using.

PROGRAM NAME: QUANTUM MECHANICS

DISK NUMBER: AP202

TOPICS: Atomic Orbitals
Quantum Mechanics
Electron Configuration

PROGRAM NAME: QUANTUM MECHANICS (continued)

USES: Demonstration
Simulation
Introduce Concept

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This simulation program allows the user to input a psi-square diagram and the computer then displays probability distributions based on that diagram. The randomness of electron motion can be demonstrated by allowing the computer to plot more than one graphic distribution for a given psi-square wave.

PROGRAM NAME: HYDROGEN

DISK NUMBER: AP201,CO201,IB201

TOPICS: Atomic Orbitals
Quantum Mechanics

USES: Simulation
Introduce Concept

LEVELS: General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program graphically portrays the radial wave functions and distribution probability diagrams from 1s to 3d for the electron of the hydrogen atom. It is an excellent lecture aid for the introduction of this topic.

PROGRAM NAME: ELECTRON ARRANGEMENT

DISK NUMBER: AP202,IB202

TOPICS: Electron Configuration

USES: Drill & Practice
Tutoring
Introduce Concept

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: The user is tutored and then allowed to practice the order of electron filling and the writing of electron configurations. A bracket diagram is used to help the user see the pattern of atomic orbital filling. There is a limited management program that allows user to keep track of scores in the practice sections. The first section could be used as a lecture aid to introduce the order of orbital filling, especially if this program is to be assigned later.

PROGRAM NAME: SPECTRAL LINES EXPERIMENT

DISK NUMBER: AP202,CO202,IB202

TOPICS: Atomic Orbitals
Electron Configuration
Quantum Mechanics

USES: Problem Solving
Data Analysis

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: User inputs distance of light band to slit of light source, distance from grating to the slit, number of lines on diffraction grating, and series being observed and the program calculates the wavelength of hydrogen spectrum radiation.

Chapter 08 The Periodic Table and the Properties of Metals

PROGRAM NAME: ORDER THE ELEMENTS (1 OF 3 CHEMISTRY GAMES)

DISK NUMBER: AP201, IB201

TOPICS: Periodicity

USES: Review
Drill & Practice

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program as individual or class review of trends in melting points, density, atomic size, ionization energy, electronegativity, number of electrons, and metallic character. A periodic table that shows only the element symbols is available to the user on keyboard command.

PROGRAM NAME: ELEMENT SEARCH

DISK NUMBER: AP902,AT901,CO902,MC902

TOPICS: Descriptive Chemistry
Periodicity
Problem Solving

PROGRAM NAME: ELEMENT SEARCH (Continued)

USES: Educational Game
Review Concepts
Problem Solving

LEVELS: High school science or chemistry
General college chemistry

DESCRIPTION: The computer assigns an unknown element to the user and answers up to eleven questions about the chemical and physical properties of that element by user request. From the answers, the user must deduce the identity of the element.

Chapter 09 Chemical Bonding

PROGRAM NAME: VSEPR

DISK NUMBER: AP301

TOPICS: Molecular Structure/Shape
Bonding

USES: Demonstration
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: By using keyboard command, the user can rotate graphic examples of compounds and ions that have two, three or four bonding groups of electrons on any or all three axis. This simulation could be used as an effective lecture aid.

Chapter 10 Molecular Structure

PROGRAM NAME: VSEPR

DISK NUMBER: AP301

TOPICS: Molecular Structure/Shape
Bonding

USES: Demonstration
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

PROGRAM NAME: VSEPR (Continued)

DESCRIPTION: By using keyboard command, the user can rotate graphic examples of compounds and ions that have two, three or four bonding groups of electrons on any or all three axis. This simulation could be used as an effective lecture aid.

PROGRAM NAME: PEEKS--1984

DISK NUMBER: AP205;IB205

TOPICS: Molecular Structure
Nuclear Chemistry
Isotopes

USES: Calculations
Research

LEVELS: Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: The computer calculates the quantitative isotopic pattern for the chemical formula input by the user, both numerically and graphically, based on successive isotopic splitting for each of the n atoms in the formula.

PROGRAM NAME: ISOMERS

DISK NUMBER: AP301,CO301,IB301

TOPICS: Isomers
Molecular Shape/Structure
Transition Metal Chemistry

USES: Drill & Practice
Demonstration
Simulation

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: This program, which presents two octahedral structures with six randomly chosen ligands for user determination as to whether the structures are identical, geometric isomers, or enantiomers, could be used to introduce the concept of isomers in the classroom setting or used as drill and practice for individual students.

Chapter 11 Liquids and Solids

PROGRAM NAME: ABS GAME

DISK NUMBER: AP501,IB501

TOPICS: Descriptive Chemistry
Problem Solving
General Review

USES: Educational Game
Review Concepts
Problem Solving

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: The physical and chemical properties of 6 compounds are randomly revealed to the user; the object of the game is to match the properties given with one of 17 possible compounds in the memory bank. This method of review and problem solving could be used by one or two individual players, or by a class that is divided into teams.

PROGRAM NAME: CAL 9

DISK NUMBER: AP402,IB402

TOPICS: Descriptive Chemistry

USES: Problem Solving
Data Analysis

LEVELS: High school science or chemistry
General college chemistry

DESCRIPTION: This program gives the user time and temperature data on heating and cooling a pure substance and the names of nine organic compounds that the unknown could be. From the data given and using a CRC Handbook, the user identifies the compound. This is a very simple application problem for beginning chemistry students.

PROGRAM NAME: CHEMPROP

DISK NUMBER: AP902,CO902

TOPICS: Descriptive Chemistry
Analytical Chemistry
Problem Solving

USES: Problem Solving
Review Concepts

PROGRAM NAME: CHEMPROP (Continued)

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Using basic laboratory tests to determine its chemical and physical properties, the user identifies the unknown compound selected by the computer. This program could be used for review and for developing some problem-solving skills.

Chapter 12 Solutions

PROGRAM NAME: RAST 2

DISK NUMBER: AP501,AT501,IB501

TOPICS: Solution Chemistry
Moles
Colligative Properties

USES: Demonstration
Introduce Concept
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This simulation program introduces the molal depression constant concept and formula. The user determines the melting point of pure camphor and the melting point of a mixture of camphor and an unknown using the Rast method by reading the balances, controlling the heat applied, and reading the final melting point. The computer gives the user a data summary and another look at the formula, so that he/she can calculate the molecular weight of the unknown.

PROGRAM NAME: CHEMICAL SEARCH

DISK NUMBER: AP902,AT901,CO902,MC902

TOPICS: Descriptive Chemistry
Problem Solving
General Review

USES: Review Concept
Problem Solving
Drill & Practice

PROGRAM NAME: CHEMICAL SEARCH (Continued)

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program to review and/or reinforce the way in which the chemical and physical properties of compounds can be used to distinguish between them, either on an individual student basis or in the classroom by dividing the class into teams, competing on the basis of number of clues necessary before the "unknown" is properly identified.

PROGRAM NAME: MOLARITY

DISK NUMBER: AP502,IB502

TOPICS: Concentration Problems

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This program randomly generates 10 problems giving either amount of solute and volume of solution, volume and concentration, or grams of solute and volume of solution. There is a limited management system that keeps track of right answers. Good program for individual use.

PROGRAM NAME: CONCENTRATION QUIZ

DISK NUMBER: AP501,IB501

TOPICS: Concentration Problems
Solution Chemistry
Solubility

USES: Problem Solving
Review Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The user is given sets of four solutions to arrange in order of decreasing concentration. Concentrations are given in terms of saturated solutions, molarity and number of molecules in a given volume. User has access to a data table of solubilities and molecular weights for assistance in making decisions. Explanations of wrong answers are given.

PROGRAM NAME: SEPARATIONS

DISK NUMBER: AP808

TOPICS:
Solubility
Bonding/Polarity
Laboratory Techniques

USES:
Tutoring
Simulation
Introduce Concept

LEVELS:
High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The two introductory sections of this program are excellent tutoring or review on the subjects of polarity and solubility of compounds. Starting with covalent bonds and electronegativity, the polarity of mainly organic molecules and its relationship to solubility is presented. Simulations of paper chromatography and an analysis of pesticides are applications of the concepts learned in the tutoring section. These could be assigned or could be a special project for beginning students.

PROGRAM NAME: WAQUAL

DISK NUMBER: AP802,IB802,AT802,CO802

TOPICS:
Environmental Chemistry
Industrial Chemistry
Problem Solving

USES:
Simulation
Problem Solving
Educational Game

LEVELS:
No background in chemistry
High school science or chemistry
Advanced first year and middle level chemistry

DESCRIPTION: In this simulation/game, the user controls the percentages of primary, secondary, and tertiary treatment at the local water treatment plant to keep the dissolved oxygen above the government standard of 5 mg/L. Introductory pages have needed information about terminology and procedures. User has the option of saving his data and returning to the game later, since it requires more than one class period to play.

Chapter 13 Structures of the Nonmetals and their Binary Compounds

PROGRAM NAME: CHEMPROP

DISK NUMBER: AP902,CO902

TOPICS: Descriptive Chemistry
Analytical Chemistry
Problem Solving

USES: Problem Solving
Review Concepts

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Using basic laboratory tests to determine its chemical and physical properties, the user identifies the unknown compound selected by the computer. This program could be used for review and for developing some problem-solving skills.

Chapter 14 Spontaneity of Reactions

PROGRAM NAME: MINERAL RESOURCES

DISK NUMBER: AP807,AT807

TOPICS: Energy
Entropy
Problem Solving

USES: Introduce Concept
Tutoring
Problem Solving

LEVELS: No background in chemistry
High school science or chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The introduction of this program can be used as a lecture aid to introduce students to the concepts of and the relationship between energy and entropy. It could also be used for tutoring an individual. The problem solver has the challenge of maintaining the supply of "metallium" for a 50-year period at a reasonable price by exploring for new resources, using more efficient mining technology, recycling, finding substitutes for metallium or using tax breaks.

PROGRAM NAME: HEATS OF REACTION

DISK NUMBER: AP1201,CO1201

TOPICS: Energy/Enthalpy
Chemical Reactions
Thermodynamics

USES: Data Collection
Data Analysis
Interfacing

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program to collect data while the chemical reaction is in progress using a thermal probe interfaced to the computer. Other programs on the disk will calibrate the probe and analyze the data collected. Requires adapter box and thermistor.Additional background and information are available in LM 005. Use a classroom demonstration or for student data collection in the laboratory.

Chapter 15 Chemical Equilibrium in the Gas Phase

PROGRAM NAME: AN EQUILIBRIUM SIMULATION

DISK NUMBER: AP603,IB603

TOPICS: Equilibrium
Chemical Reactions
Reaction Rates

USES: Demonstration
Introduce Concept
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This simulation of the formation of HI from its elements shows the activation energy curve; it allows the user to input beginning concentrations of reactants and product and to upset the equilibrium once it is achieved. If you are going to use thisfor a classroom demonstration, decide before class what values to input, since some concentrations require longer than a class period to come to equilibrium--but maybe you want to show students how long it really takes for this to happen!

PROGRAM NAME: XENON

DISK NUMBER: AP605

TOPICS: Equilibrium
Problem Solving
Laboratory Techniques

USES: Simulation
Problem Solving

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chem

DESCRIPTION: The user of this program will be applying the equilibrium concept to the production of xenon fluorides. Not only does the user control temperature and pressure of the gases, but also manipulates the valves in the vacuum system on the screen. Student users will need background before starting this lab simulation. There is excellent documentation on the back of this disk.

PROGRAM NAME: BALL TOSS

DISK NUMBER: AP601,IB601

TOPICS: Equilibrium

USES: Simulation
Demonstration

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: This is a very simplified simulation of equilibrium, using balls to represent reactants and products. The user inputs the number of initial reactants and products and forward and reverse rates. The computer calculates the equilibrium constant. Theuser can compare constants based on different concentrations (different number of balls) of reactants and products.

PROGRAM NAME: EQUIL TIC-TAC-TOE

DISK NUMBER: AP603,IB603

TOPICS: Equilibrium
Problem Solving

USES: Educational Game
Problem Solving
Review Concept

PROGRAM NAME: EQUIL TIC-TAC-TOE (Continued)

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Correct answers to solution and acid-base equilibrium problems earn the users X's or O's on the Tic-Tac-Toe board. User(s) should have a calculator handy. An excellent way to apply the equilibrium concepts.

Chapter 16 Rate of Reaction

PROGRAM NAME: GENERAL LABORATORY INTERFACING

DISK NUMBER: AP1203,C01203

TOPICS: Interfacing

USES: Data Collection
Data Analysis
Interfacing

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: User can calibrate and test a thermistor or Blocktronic I interfaced to the computer. The devices can then be used to monitor changes continuously or sample at intervals. Both graphic and numeric data displays are available and data files can be created. The written materials in LM 010, LM 002, and LM 003 contain specific instructions for construction and use of the interface devices.

PROGRAM NAME: MOLECULAR SPEED DISTRIBUTION

DISK NUMBER: AP603,IB603

TOPICS: Kinetics
Reaction Rates
Gas Laws

USES: Demonstration
Introduce Concept
Simulation

LEVELS: High school chemistry or science
General college chemistry
Advanced first year and middle level chemistry

PROGRAM NAME: MOLECULAR SPEED DISTRIBUTION (Continued)

DESCRIPTION: The ability to graph the speed distribution for a gas of your choice at many temperatures on the same screen makes this simulation program a natural for classroom demonstration of the relationship between molecular speed and reaction rates. You can use a temperature range from 1K to above 10,000K.

PROGRAM NAME: AN EQUILIBRIUM SIMULATION

DISK NUMBER: AP603,IB603

TOPICS: Equilibrium
Chemical Reactions
Reaction Rates

USES: Demonstration
Introduce Concept
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This simulation of the formation of HI from its elements shows the activation energy curve; it allows the user to input beginning concentrations of reactants and product and to upset the equilibrium once it is achieved. If you are going to use thisfor a classroom demonstration, decide before class what values to input, since some concentrations require longer than a class period to come to equilibrium--but maybe you want to show students how long it really takes for this to happen!

PROGRAM NAME: KINTHERM and KINTHERM STANDARDS

DISK NUMBER: AP606

TOPICS: Thermodynamics
Kinetics
Equilibrium

USES: Data Analysis
Simulation
Demonstration

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chem

DESCRIPTION: For advanced students who want a challenge, this is it! User may input equilibrium constants and time and the program plots the concentration-time curves for the reaction. For classroom lecture and demonstration, the KINTHERM STANDARDS program has eight curves obtained from KINTHERM that can be used for comparative purposes.

PROGRAM NAME: REACTION RATES

DISK NUMBER: AP601,IB601

TOPICS: Equilibrium
Reaction Rates

USES: Demonstration
Simulation
Introduce Concept

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: The user inputs the initial forward and reverse reaction rates and the computer graphically demonstrates how the number of reactants and products changes over time. The user can watch equilibrium being established. The changing populations are given in bar graph and numerical ratio forms. This program can be used as an individual student assignment or for classroom demonstration.

PROGRAM NAME: RATES

DISK NUMBER: AP601,IB601

TOPICS: Reaction Rates
Kinetics

USES: Demonstration
Data Collection
Simulation

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: User inputs quantities of reactants in this "clock" reaction simulation of the hydrolysis of t-butyl chloride and times the reaction in real or compressed time. A color monitor makes this a more effective classroom demonstration, but it can be satisfactorily used for data collection with b/w monitor.

PROGRAM NAME: KINETICS--A SIMULATION LAB

DISK NUMBER: AP601,IB601

TOPICS: Reaction Rates
Kinetics
Laboratory Techniques

USES: Simulation
Pre Lab Discussion
Data Collection

PROGRAM NAME: KINETICS--A SIMULATION LAB (Continued)

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: Use this simulation program as a pre-lab practice or to actually collect data for the starch-iodine clock reaction. Excellent graphics and specific instructions take the user through the lab procedure, choosing solutions, rinsing glassware, and mixing the solutions. Options include setting temperature and selecting different concentrations of all solutions.

PROGRAM NAME: BUCL

DISK NUMBER: AP604

TOPICS: Reaction Rates
Kinetics
Organic Chemistry

USES: Simulation
Data Collection
Demonstration

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Because this program allows the user to change either temperature or solvent concentration or both, the effect of these variables on the rate of reaction can be studied--either by an individual student or by a class as a whole if used as a demonstration aid.

PROGRAM NAME: ANIMATION

DISK NUMBER: AP603

TOPICS: Reaction Mechanisms
Organic Chemistry

USES: Simulation
Demonstration
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The ANIMATION of this program simulates the multi-step mechanism of the chlorination of methane. A simultaneous printout at the bottom of the screen keeps tally of each species in the mechanism. Because the sequence may be stopped and started withkeyboard commands, this program could be used as a lecture aid to introduce or demonstrate reaction mechanisms.

PROGRAM NAME: SULFURIC ACID

DISK NUMBER: AP801,AT801,CO801,IB801,MC801

TOPICS: Industrial Chemistry
Equilibrium
Problem Solving

USES: Simulation
Problem Solving
Tutoring

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this simulation program to help students apply the chemical principles of reaction rates and equilibrium. The user selects the starting materials and reaction conditions to get the greatest possible yield with the least pollution emission and for the lowest cost. The introduction of the program can also be used for tutoring.

Chapter 17 The Atmosphere

PROGRAM NAME: SULFURIC ACID

DISK NUMBER: AP801,AT801,CO801,IB801,MC801

TOPICS: Industrial Chemistry
Equilibrium
Problem Solving

USES: Simulation
Problem Solving
Tutoring

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this simulation program to help students apply the chemical principles of reaction rates and equilibrium. The user selects the starting materials and reaction conditions to get the greatest possible yield with the least pollution emission and for the lowest cost. The introduction of the program can also be used for tutoring.

PROGRAM NAME: LAKE STUDY

DISK NUMBER: AP804,AT804

PROGRAM NAME: LAKE STUDY (Continued)

TOPICS: Environmental Chemistry
Problem Solving
Methods of Chemistry

USES: Problem Solving
Simulation

LEVELS: No background in chemistry
High school science or chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program guides the user through the steps of solving a scientific problem--a fish kill in a hatchery. Animation allows the user to search the library, to use colleagues' expertise, to sample and analyze lake water, and to check the fish in order to identify the pollutant killing the fish. In the second part of the program the user sets up controlled experiments in the lab to check the hypothesis in part one.

PROGRAM NAME: POND STUDY

DISK NUMBER: AP809

TOPICS: Environmental Chemistry
Problem Solving
Methods of Chemistry

USES: Problem Solving
Educational Game
Simulation

LEVELS: No background in chemistry
High school science or chemistry

DESCRIPTION: The user(s) is an ecologist who has been asked to develop a hypothesis about what is causing a fish kill. The report must be supported by experimental and literature data. A simulated library and laboratory are available to the user. The same format as LAKE STUDY (AP804) but less rigorous. Good application of scientific method.

Chapter 18 Precipitation Reactions

PROGRAM NAME: SIX SOLUTION PROBLEM

DISK NUMBER: AP902,AT901,CO902,IB902,MC901

TOPICS: Descriptive Chemistry
Solution Chemistry
Periodicity

PROGRAM NAME: SIX SOLUTION PROBLEM (Continued)

USES: Problem Solving
Educational Game
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program, which needs a color monitor to be effective, could be used on first day of class to stimulate interest in the course. Later on it could be used to introduce solution chemistry or periodicity, since it uses three sodium salts (two are sodium halides) and silver nitrate. SIX SOLUTIONS was designed for problem solving; the user mixes the six solutions, two at a time, in a spot plate and from the results determines the contents of the six test tubes.

PROGRAM NAME: SEPARATIONS

DISK NUMBER: AP808

TOPICS: Solubility
Bonding/Polarity
Laboratory Techniques

USES: Tutoring
Simulation
Introduce Concept

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The two introductory sections of this program are excellent tutoring or review on the subjects of polarity and solubility of compounds. Starting with covalent bonds and electronegativity, the polarity of mainly organic molecules and its relationship to solubility is presented. Simulations of paper chromatography and an analysis of pesticides are applications of the concepts learned in the tutoring section. These could be assigned or could be a special project for beginning students.

PROGRAM NAME: PRECIPITATION GAME

DISK NUMBER: AP502,IB502

TOPICS: Solution Chemistry
Solubility
Equilibrium

USES: Educational Game
Problem Solving

PROGRAM NAME: PRECIPITATION GAME (Continued)

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: In this educational game, two players are each given sets of five cations and ten anions. The object is to form as many precipitates as you can during your turn. When one player makes a mistake, the screen changes ion sets and the other player forms precipitates. The instructor has the option of letting students use solubility tables during play.

PROGRAM NAME: SOLUBILITY

DISK NUMBER: AP502,IB502

TOPICS: Solubility
Chemical Reactions
Chemical Formulas

USES: Educational Game
Review Concepts
Problem Solving

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Up to four players can use this program. Each is randomly dealt from four to eight ions and is given the choice to form a precipitate, a gas, or pass. Two chances are given to score from each set of ions. This is a fun way to review solubility.

Chapter 19 Acids and Bases

PROGRAM NAME: EXCESS

DISK NUMBER: AP301,IB301

TOPICS: Acid-Base Chemistry
Stoichiometry
Equilibrium

USES: Demonstration
Introduce Concept
Post Lab Discussion

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

PROGRAM NAME: EXCESS (Continued)

DESCRIPTION: EXCESS was designed for classroom demonstration to introduce the concept of excess reagent. It is especially effective for showing what happens to the pH of the solution as you get close to the endpoint of a titration, since the computer calculates the pH as well as the moles of excess reagent and moles of water formed.

PROGRAM NAME: TITRATION CURVES

DISK NUMBER: AP501,IB501

TOPICS: Acid-Base Chemistry
Analytical Chemistry
Equilibrium

USES: Tutoring
Demonstration
Introduce Concept

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: Because this program allows the user to input the name, dissociation constant, and the concentration of the acid, it could be used to introduce the concepts of weak, diprotic, and triprotic acids by comparing the graphs of their titrations with a strong base. A printout of the concentrations of H+, HA, B, and A- at every .25 change in pH is available. The explanation section is good for tutoring the user.

PROGRAM NAME: ACID STRENGTH

DISK NUMBER: AP501,IB501

TOPICS: Acid-Base Chemistry
Equilibrium
Solution Chemistry

USES: Demonstration
Introduce Concept
Tutoring

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: The first screens of this program are tutorial on the concept of the dissociation of strong and weak acids. For demonstration or to use the program to introduce the concept, start with the graphic representation of the dissociation of HX to H+ and X-, then watch the acid molecules dissociate on screen and compare the percent dissociations that are calculated.

PROGRAM NAME: pH (7 Programs)

DISK NUMBER: AP502,IB502

TOPICS: Acid-Base Chemistry

USES: Tutoring
Drill & Practice

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: These seven tutoring programs cover acid-base concepts, including integer and fraction pH, strong and weak acids, Ka, [H+], [OH-], buffer solutions and titration. The user is given quantitative problems to solve, most of which require the use of a calculator.

PROGRAM NAME: pH PLOT

DISK NUMBER: AP503

TOPICS: Acid-Base Chemistry
Analytical Chemistry
Equilibrium

USES: Demonstration
Lab Data Check
Simulation

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: With keyboard commands the user can titrate strong or weak acids against strong or weak bases. The introduction section explains the use of equilibrium expressions to calculate the pH of the solution during titration. This program can plot titration curves faster than performing the real titration with pH meter, can be used to check student calculations, and to determine the volume at which neutralization occurs graphically and mathematically.

PROGRAM NAME: WEAK ACID/BASE

DISK NUMBER: AP501,IB501

TOPICS: Acid-Base Chemistry

USES: Tutoring
Drill & Practice

PROGRAM NAME: WEAK ACID/BASE (Continued)

LEVELS: General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: User is given the molarity and dissociation constant for a weak acid in aqueous solution at room temperature and must solve for the pH of the acid. In some cases the quadratic equation must be used. There is an option of using the printer or the screen during the "check" session, where an explanation is given for wrong answers.

PROGRAM NAME: ACID-BASE PROBLEMS

DISK NUMBER: AP501,IB501

TOPICS: Acid-Base Chemistry
Concentration Terminology/Problems

USES: Review
Drill & Practice

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: Up to six players may use this program to compete for top score in solving normality and molarity problems, for [H+] and [OH-] using Kw, for pH given [H+] or [OH-], or titration problems given concentration of either the acid or base. Each player solves the same problem, but is assigned a different numerical "given" amount.

Chapter 20 Acid-Base Equilibria

PROGRAM NAME: LOWRY/BRONSTED

DISK NUMBER: AP501,IB501

TOPICS: Acid-Base Chemistry

USES: Tutoring
Drill & Practice
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: An excellent tutoring and practice program that focuses on the Bronsted/Lowry concept of conjugate acid/base pairs. In the problem portion, the user may choose up to nine acids to arrange in order of decreasing strength based upon the equilibrium reactions given. The problem section could be used in a classroom setting.

PROGRAM NAME: EQUIL TIC-TAC-TOE

DISK NUMBER: AP603,IB603

TOPICS: Equilibrium
Problem Solving

USES: Educational Game
Problem Solving
Review Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Correct answers to solution and acid-base equilibrium problems earn the users X's or O's on the Tic-Tac-Toe board. User(s) should have a calculator handy. An excellent way to apply the equilibrium concepts.

PROGRAM NAME: EQUILIBRIUM SIMULATION

DISK NUMBER: AP601,IB601

TOPICS: Equilibrium
Chemical Reactions

USES: Demonstration
Simulation
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: EQUILIBRIUM SIMULATION program allows the user to choose the time lapse of display cycle, the original concentrations of the reactants and products for the reaction of acetic acid and ethanol to form water and ethyl acetate. This reaction takes about two hours to come to equilibrium in real time. The graphic form of data display is very effective for classroom demonstration.

PROGRAM NAME: ACID-BASE PROBLEMS

DISK NUMBER: AP501,IB501

TOPICS: Acid-Base Chemistry
Concentration Terminology/Problems

USES: Review
Drill & Practice

PROGRAM NAME: ACID-BASE PROBLEMS (Continued)

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: Up to six players may use this program to compete for top score in solving normality and molarity problems, for [H+] and [OH-] using Kw, for pH given [H+] or [OH-], or titration problems given concentration of either the acid or base. Each player solves the same problem, but is assigned a different numerical "given" amount.

PROGRAM NAME: BACKTITER

DISK NUMBER: AP604

TOPICS: Analytical Chemistry
Quantative Analysis
Laboratory Techniques

USES: Simulation

LEVELS: General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The technique of back titration to analyze a complex mixture of carbonates is simulated in this program. The user has the option of computer-standardized solutions or user can standardize with the computer's help. This program can be used as a pre-lab assignment to acquaint students with the technique or to actually collect data to determine the composition of the mixture of sodium carbonate and bicarbonate.

PROGRAM NAME: CHEMICAL DUNGEONS

DISK NUMBER: AP602

TOPICS: Problem Solving
Solution Chemistry
Chemical Reactions

USES: Educational Game
Problem Solving

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: In this chemical adventure game the user solves chemistry-related problems in order to get through the dungeon alive with the treasure. The dungeon has 51 rooms with eleven chemical problems to be solved. A roving professor quizzes the user on different aspects of chemistry from a bank of randomly accessed questions.

Chapter 21 Complex Ions: Coordination Compounds

PROGRAM NAME: GENERAL LABORATORY INTERFACING

DISK NUMBER: AP1203,C01203

TOPICS: Interfacing

USES: Data Collection
Data Analysis
Interfacing

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: User can calibrate and test a thermistor or Blocktronic I interfaced to the computer. The devices can then be used to monitor changes continuously or sample at intervals. Both graphic and numeric data displays are available and data files can be created. The written materials in LM 010, LM 002, and LM 003 contain specific instructions for construction and use of the interface devices.

PROGRAM NAME: ISOMERS

DISK NUMBER: AP301,C0301,IB301

TOPICS: Isomers
Molecular Shape/Structure
Transition Metal Chemistry

USES: Drill & Practice
Demonstration
Simulation

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: This program, which presents two octahedral structures with six randomly chosen ligands for user determination as to whether the structures are identical, geometric isomers, or enantiomers, could be used to introduce the concept of isomers in the classroom setting or used as drill and practice for individual students.

PROGRAM NAME: PHOTOCHROMIC KINETICS

DISK NUMBER: AP1202,C01202

TOPICS: Kinetics
Transition Metal Chemistry
Reaction Rates

PROGRAM NAME: PHOTOCHROMIC KINETICS (Continued)

USES: Data Collection
Data Analysis
Interfacing

LEVELS: General College Chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chem

DESCRIPTION: This program interfaces with a "Blocktronic" colorimeter to measure the rate of thermal decay of heavy metal complexes that have been radiated with strong visible light. Other programs on the disk may be used for data analysis. Requires the use of an adapter box and Blocktronic I. Additional background and lab procedure is available in LM 002.

Chapter 22 Qualitative Analysis

PROGRAM NAME: CANAL 1,2,3

DISK NUMBER: AP902,AT901,CO902,IB902,MC901

TOPICS: Analytical Chemistry
Qualitative Analysis

USES: Simulation
Problem Solving
Review Concept

LEVELS: High school science or chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: These simulations of qualitative analysis schemes for groups 1, 2, and 3 could be used as a pre-lab review or quiz, as a substitute for the lab, or as a review before a lab test.

PROGRAM NAME: CANAL 4,5

DISK NUMBER: AP902,MC901

TOPICS: Analytical Chemistry
Qualitative Analysis
Problem Solving

USES: Simulation
Review Concept
Problem Solving

LEVELS: Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chem

PROGRAM NAME: CANAL 4,5 (Continued)

DESCRIPTION: These simulations of the qualitative analysis schemes for groups 4 and 5 could be used as pre-lab tests or tutoring, as substitution for the lab itself, or for post-lab review.

Chapter 23 Oxidation and Reduction: Electrochemical Cells

PROGRAM NAME: ELECTRODEP

DISK NUMBER: AP604

TOPICS: Electrochemistry, Electrolysis
Oxidation-Reduction Chemistry
Atomic Structure

USES: Data Collection
Pre-lab Discussion
Demonstration

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program as a pre-lab discussion if you assign an electrodeposition lab. Correct lab procedure is simulated. Otherwise use as a demonstration where you collect data to solve for equivalent weights of copper or a mystery metal. User has option of controlling time and current.

PROGRAM NAME: LIMITING REAGENT

DISK NUMBER: AP306

TOPICS: Oxidation-Reduction Chemistry
Stoichiometry

USES: Problem Solving
Drill & Practice

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program has a series of four redox reactions that have a minimum of three reactants. The user is to find the limiting reactant. Hints are provided and the user's score is kept. Useful as individual practice or quiz.

PROGRAM NAME: BALANCE

DISK NUMBER: AP601

TOPICS: Oxidation-Reduction Chemistry

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry

DESCRIPTION: User chooses the number of oxidation-reduction equations to solve and whether to use the printer or screen to "check" user's solutions. Modification guidelines are available in AM009.

PROGRAM NAME: FARADAY 2 (and FARADAY AID)

DISK NUMBER: AP603,IB603

TOPICS: Electrochemistry/Electrolysis
Chemical Reactions
Oxidation-Reduction Chemistry

USES: Tutoring
Demonstration
Data Collection

LEVELS: High school science or chemistry
General college chemistry

DESCRIPTION: The instruction section of this program introduces the concepts of electrolysis, coulombs, and Faradays. The user may set the temperature, pressure and time (and if you have paddles, can change the amount of current) in this electrolysis of water simulation and then read the volume of each gas collected in order to calculate the value of a Faraday (see Faraday Aid for help). The simulation itself could be used as a lecture aid to introduce the topics of electrolysis or redox reactions.

Chapter 24 Oxidation and Reduction: Cell Voltages

PROGRAM NAME: REDOX GAME

DISK NUMBER: AP306

TOPICS: Oxidation-Reduction Chemistry

USES: Educational Game
Problem Solving

PROGRAM NAME: REDOX GAME (Continued)

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: To be a winner of this "high voltage game," you need a table of Electrode Potentials, a fast keyboard finger, and the luck of the random draw from the computer's data base. Two players can be accommodated at a time.

PROGRAM NAME: NERNST

DISK NUMBER: AP601,IB601

TOPICS: Electrochemistry
Oxidation-Reduction Chemistry

USES: Drill & Practice

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: This program offers the user a choice of the number of problems on calculating cell voltages at standard and non-standard conditions and an option of checking user's work on the screen or printer. Help and hints are available when wrong answers are input. Modification guidelines for this program are available in AM009.

Chapter 25 Chemistry of the Transition Metals

PROGRAM NAME: ISOMERS

DISK NUMBER: AP301,CO301,IB301

TOPICS: Isomers
Molecular Shape/Structure
Transition Metal Chemistry

USES: Drill & Practice
Demonstration
Simulation

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: This program, which presents two octahedral structures with six randomly chosen ligands for user determination as to whether the structures are identical, geometric isomers, or enantiomers, could be used to introduce the concept of isomers in the classroom setting or used as drill and practice for individual students.

PROGRAM NAME: PHOTOCHROMIC KINETICS

DISK NUMBER: AP1202,CO1202

TOPICS: Kinetics
Transition Metal Chemistry
Reaction Rates

USES: Data Collection
Data Analysis
Interfacing

LEVELS: General College Chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chem

DESCRIPTION: This program interfaces with a "Blocktronic" colorimeter to measure the rate of thermal decay of heavy metal complexes that have been radiated with strong visible light. Other programs on the disk may be used for data analysis. Requires the use of an adapter box and Blocktronic I. Additional background and lab procedure is available in LM 002.

Chapter 26 Chemistry of the Nonmetals

PROGRAM NAME: XENON

DISK NUMBER: AP605

TOPICS: Equilibrium
Problem Solving
Laboratory Techniques

USES: Simulation
Problem Solving

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: The user of this program will be applying the equilibrium concept to the production of xenon fluorides. Not only does the user control temperature and pressure of the gases, but also manipulates the valves in the vacuum system on the screen. Student users will need background before starting this lab simulation. There is excellent documentation on the back of this disk.

Chapter 27 Nuclear Reactions

PROGRAM NAME: DECAY

DISK NUMBER: AP1001

TOPICS: Nuclear Chemistry/Radiation
Atomic Structure

USES: Simulation
Demonstration
Data Collection

LEVELS: No background in chemistry
High school science or chemistry
General college chemistry

DESCRIPTION: Collect the data from three or more successive runs of this program to illustrate the "randomness" of radioactive decay. The graphics in this program are suitable for use as a classroom demonstration that simulates the decay of 1000 atoms of a mystery substance. A hard copy of the data can be obtained or a bar graph is available on screen.

Chapter 28 Organic Molecules, Small and Large

PROGRAM NAME: CHEMICAL HANGMAN (1 OF 3 CHEMISTRY GAMES)

DISK NUMBER: AP201,IB201,TR001

TOPICS: Vocabulary
General Review

USES: Review
Educational Game

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Students can review chemistry vocabulary by playing the traditional game of Hangman. Terms include organic family names, vocabulary from atomic and molecular structure, gas laws, thermodynamics, solutions, equilibrium, periodicity, and bonding.

PROGRAM NAME: LAKE STUDY

DISK NUMBER: AP804,AT804

TOPICS: Environmental Chemistry
Problem Solving
Methods of Chemistry

PROGRAM NAME: LAKE STUDY (continued)

USES: Problem Solving
Simulation

LEVELS: No background in chemistry
High school science or chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This program guides the user through the steps of solving a scientific problem--a fish kill in a hatchery. Animation allows the user to search the library, to use colleagues' expertise, to sample and analyze lake water, and to check the fish in order to identify the pollutant killing the fish. In the second part of the program the user sets up controlled experiments in the lab to check the hypothesis in part one.

PROGRAM NAME: POND STUDY

DISK NUMBER: AP809

TOPICS: Environmental Chemistry
Problem Solving
Methods of Chemistry

USES: Problem Solving
Educational Game
Simulation

LEVELS: No background in chemistry
High school science or chemistry

DESCRIPTION: The user(s) is an ecologist who has been asked to develop a hypothesis about what is causing a fish kill. The report must be supported by experimental and literature data. A simulated library and laboratory are available to the user. The same format as LAKE STUDY (AP804) but less rigorous. Good application of scientific method.

PROGRAM NAME: CHEMICAL PURSUIT

DISK NUMBER: AP206

TOPICS: General Review

USES: Educational Game
Review Concepts

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

PROGRAM NAME: CHEMICAL PURSUIT (Continued)

DESCRIPTION: Based on the format of Trivial Pursuit, this educational game has questions from physical, organic, inorganic, periodic trends, history, and structure categories. A maximum of four players, with calculators and periodic tables, can play. On the same disk (AP206) are file programs that allow the instructor to edit or add questions to the game file.

PROGRAM NAME: BUCL

DISK NUMBER: A0604

TOPICS: Reaction Rates
Kinetics
Organic Chemistry

USES: Simulation
Data Collection
Demonstration

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Because this program allows the user to change either temperature or solvent concentration or both, the effect of these variables on the rate of reaction can be studied--either by an individual student or by a class as a whole if used as a demonstration aid.

PROGRAM NAME: ANIMATION

DISK NUMBER: AP603

TOPICS: Reaction Mechanisms
Organic Chemistry

USES: Simulation
Demonstration
Introduce Concept

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: The ANIMATION of this program simulates the multi-step mechanism of the chlorination of methane. A simultaneous printout at the bottom of the screen keeps tally of each species in the mechanism. Because the sequence may be stopped and started withkeyboard commands, this program could be used as a lecture aid to introduce or demonstrate reaction mechanisms.

PROGRAM NAME: DESIGN-A-DRUG

DISK NUMBER: AP701,IB701

TOPICS: Pharmacology
Biochemistry
Organic Chemistry

USES: Educational Game
Problem Solving
Simulation

LEVELS: General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Using a parent molecular structure that has active sites identified, the user selects an atom or group to be added at each site to form a tranquilizer drug which the computer then "tests" for biological activity. The game was designed to stimulate interest in organic and medicinal chemistry; therefore, trial and error can be used, but some knowledge of how changes in electronegativity, charge and size affect "activity" of synthesized molecules is helpful.

PROGRAM NAME: OCTANE

DISK NUMBER: AP803,IB803,AT803

TOPICS: Organic Chemistry
Combustion Reactions

USES: Educational Game
Tutoring

LEVELS: No background in chemistry
High school science or chemistry
General college chemistry

DESCRIPTION: This program has extensive tutoring pages in hydrocarbon chemistry, which it relates to octane numbers and compression ratios. The user applies this information to winning a traveling game by arriving at a chosen destination without running out of money. Good application of hydrocarbon properties to the operation of cars--an interest area of most teenage students.

PROGRAM NAME: REFINERY

DISK NUMBER: AP806,AT806

TOPICS: Industrial Chemistry
Organic Chemistry
Problem Solving

PROGRAM NAME: REFINERY (Continued)

USES: Educational Game
Tutoring

LEVELS: No background in chemistry
High school science or chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Extensive tutoring pages give the user enough background to become the Operations Manager of a refinery. The job description includes purchasing crude oil to meet specified demands, refining it and making a profit. Excellent for developing problem solving skills.

PROGRAM NAME: POLYMERLAB

DISK NUMBER: AP702

TOPICS: Polymer Chemistry
Analytical Chemistry
Instrumentation

USES: Educational Game

LEVELS: Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: Using an adventure game format, this educational game allows students to use IR, DSC, light scattering techniques, etc. to identify an unknown polymer.

PROGRAM NAME: CAMM: Conformational Analysis & Molecular Modeling

DISK NUMBER: AP704

TOPICS: Organic Chemistry
Molecular Structure/Shape

USES: Demonstration
Simulation
Introduce Concept

LEVELS: General college chemistry
Advanced first year and middle level chemistry
Advanced undergraduate or first year graduate chemistry

DESCRIPTION: This program contains excellent 3-D graphical representations of organic molecules which can be rotated on an axis or a bond by use of keyboard commands. At the bottom of the screen, there is a simultaneous graphing of the potential energy changes due to the conformational changes. Use for classroom lecture aid or for individual student assignment.

PROGRAM NAME: POLYMERIZATION

DISK NUMBER: AP705

TOPICS: Polymer Chemistry
Organic Chemistry

USES: Tutoring
Simulation
Demonstration

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This tutorial program was designed to introduce the concepts of addition and condensation polymerization to the user. Parts of the program could be used as a classroom demonstration or lecture aid. Extensive documentation and background information is available as IT 006.

PROGRAM NAME: ORGANIC NOMENCLATURE

DISK NUMBER: AP705

TOPICS: Organic Nomenclature

USES: Drill & Practice

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This drill and practice program generates structural formulae of organic compounds in random sequence by functional groups and the user inputs the correct IUPAC name of the compound. There is a limited management system; user's score is kept by group of problems.

PROGRAM NAME: CONFORMATIONAL ANALYSIS

DISK NUMBER: AP706

TOPICS: Molecular Structure/Shape
Organic Chemistry
Bonding

USES: Tutoring
Drill & Practice
Demonstration

PROGRAM NAME: CONFORMATIONAL ANALYSIS (Continued)

LEVELS: General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: This tutoring program will help students visualize two-dimensional drawings of organic molecules in 3-D. The drill segments are appropriate for individual use or as demonstration aid for classroom lecture. Included are recognition of sawhorse and Newman projections of methane, ethane, and butane.

General Review Recommendations

PROGRAM NAME: CHEMICAL SEARCH

DISK NUMBER: AP902,AT901,CO902,MC902

TOPICS: Descriptive Chemistry
Problem Solving
General Review

USES: Review Concept
Problem Solving
Drill & Practice

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Use this program to review and/or reinforce the way in which the chemical and physical properties of compounds can be used to distinguish between them, either on an individual student basis or in the classroom by dividing the class into teams, competing on the basis of number of clues necessary before the "unknown" is properly identified.

PROGRAM NAME: ABS GAME

DISK NUMBER: AP501,IB501

TOPICS: Descriptive Chemistry
Problem Solving
General Review

USES: Educational Game
Review Concepts
Problem Solving

LEVELS: High school chemistry
General college chemistry

PROGRAM NAME: ABS GAME (Continued)

DESCRIPTION: The physical and chemical properties of 6 compounds are randomly revealed to the user; the object of the game is to match the properties given with one of 17 possible compounds in the memory bank. This method of review and problem solving could be used by one or two individual players, or by a class that is divided into teams.

PROGRAM NAME: CHEMPROP

DISK NUMBER: AP902,CO902

TOPICS: Descriptive Chemistry
Analytical Chemistry
Problem Solving

USES: Problem Solving
Review Concepts

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Using basic laboratory tests to determine its chemical and physical properties, the user identifies the unknown compound selected by the computer. This program could be used for review and for developing some problem-solving skills.

PROGRAM NAME: CHEMICAL DUNGEONS

DISK NUMBER: AP602

TOPICS: Problem Solving
Solution Chemistry
Chemical Reactions

USES: Educational Game
Problem Solving

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: In this chemical adventure game the user solves chemistry-related problems in order to get through the dungeon alive with the treasure. The dungeon has 51 rooms with eleven chemical problems to be solved. A roving professor quizzes the user on different aspects of chemistry from a bank of randomly accessed questions.

PROGRAM NAME: Chemical Hangman

DISK NUMBER: AP201,IB201,TR001

TOPICS: Vocabulary
General Review

USES: Review
Educational Game

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Students can review chemistry vocabulary by playing the traditional game of Hangman. Terms include organic family names, vocabulary from atomic and molecular structure, gas laws, thermodynamics, solutions, equilibrium, periodicity, and bonding.

PROGRAM NAME: CHEMICAL PURSUIT

DISK NUMBER: AP206

TOPICS: General Review

USES: Educational Game
Review Concepts

LEVELS: High school chemistry
General college chemistry
Advanced first year and middle level chemistry

DESCRIPTION: Based on the format of Trivial Pursuit, this educational game has questions from physical, organic, inorganic, periodic trends, history, and structure categories. A maximum of four players, with calculators and periodic tables, can play. On the same disk (AP206) are file programs that allow the instructor to edit or add questions to the game file.

Sample Entry

from the forthcoming publication

Teaching Tips: SERAPHIM Software

BOHR ATOM

Written by Robert Rittenhouse

SERAPHIM APPLE DISK AP201

WHEN TO USE THIS PROGRAM

TOPICS: Atomic Orbitals
Atomic Structure
Electron Configuration

DESCRIPTION:

This program is an effective lecture aid in teaching the following concepts related to characteristics of electrons and atomic structure.

1) You can show that an electron must have exactly the right energy photon to raise it from ground state to an excited state. It cannot "save" energy from successive low-energy "hits" and it cannot "give change" when a photon of too-high energy strikes.

   For example, to raise the electron from energy level 1 to level 4 requires a photon that has a wavelength of 97 nanometers. By changing the wavelength to either 96 or 98 nanometers, you can show that the electron is not affected by either of these wavelengths.

2) The simulation clearly shows that the electron must absorb energy to go to a higher energy level and that energy is given off when it falls back to a lower energy level.

3) The graphic representation shown on the right side of the simulation screen relates the animation to the diagrams of the hydrogen spectrum usually shown in chemistry text books. The lines on the graph appear simultaneously with the animation.

4) Because the energy of the photon is related to wave length on the screen, the relationship between wave length and frequency and the relationship between frequency and energy of radiation can be emphasized.

5) When the electron is excited from energy level one to level four, it is done in one jump; when it falls, however, it comes down in two stages--to level two and then to level one. Use this simulation to explain why a one-electron system can have a multiple of spectral lines.

HOW TO USE THIS PROGRAM

HARDWARE/MEMORY REQUIREMENTS:

This program will run on any of the Apple II family, with 1 disk drive, DOS 3.3.

GETTING STARTED:

Copy the documentation (side 2 of the master disk) on a separate disk before making a print out. Do not attempt to use the back side of the disk more than twice to insure the integrity of the master disk. To make a copy of side 2, boot up an Apple System Master, DOS 3.3, and type RUN COPYA. Press RETURN. Follow the instructions of the program, using side 2 of the master disk as the source disk.

Boot up Disk #201 by inserting the disk into the disk drive, closing the disk drive door, and turning on the computer. You will find the switch on the left-hand side on the back of the Apple. Turn on the monitor. The Project SERAPHIM title page should appear on the screen.

RUNNING THE PROGRAM:

Press RETURN until the Program Entries menu appears and choose #12 BOHR ATOM by using the --> key to move the highlight to #12. Press RETURN and the program will load.

The program has two pages of introduction and one page of instructions. You can go back to the instruction page from any point in the program by pressing the I key.

When the simulation page is on the screen, you may use any of the following commands:

Press F to fire photons of the wavelength indicated (Note that the instructions indicate that you can get continuous photons firing by using the REPEAT key. On Apple models that do not have the REPEAT key, just hold the F(ire) key down continually)

--> to increase the wavelength being fired

<-- to decrease the wavelength being fired (note that the wavelength range is from 80-130 nanometers)

I to go back to the instruction page

E to see the example, which shows you the numerical values of the first four energy levels in the hydrogen atom. It also shows the partial calculation of the wavelength necessary to excite the electron from the first to the second energy level.

GETTING OUT OF THE PROGRAM:

Press X to exit the program . The simulation will remain on the screen. If you wish to use another program on this disk, reboot the disk by turning off the machine and turning it back on or press CONTROL, the OPEN APPLE and RESET at the same time. Take the disk out of the disk drive ONLY when the red light on the drive is out.

TO MAKE A SEPARATE PROGRAM DISK:

If you wish to copy this program to another disk, follow the directions found in "How to Make Your Own Seraphim Disk." You will need to copy the following files from your master disk:

HELLO1
AUX
BOHR.OBJ
UNPACKER
BOHR
BOHR.SH
SCR-BOHR-1.PAK
SCR-BOHR-2.PAK
SCR-BOHR-3.PAK
SCR-BOHR-4.PAK
SCR-BOHR-5.PAK
SCR-BOHR-6.PAK
SCR-BOHR-7.PAK

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AP 999	*Apple Disk Package (7/85: set of 34)	1	160.00	
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*Package description on reverse side.

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